

Summary of June 13-14, 2012 meeting of the Science and TEK Subcommittee of the NPLCC

The Science and Traditional Ecological Knowledge subcommittee (S-TEK) of the NPLCC held a meeting on June 13 and 14, 2012 in Portland, Oregon. This was the fourth meeting (including web-based meetings) of the subcommittee. Twenty-two subcommittee members or their alternates participated either in person or by phone and web over the course of the two days. A list of participants is included as Appendix A. This document briefly summarizes the meeting conclusions, some of the challenges the subcommittee still faces, and the next steps agreed upon at the meeting.

Update on FY12 activities

Frank Shipley (Chair) opened the meeting with introductions, a review of FY12 activities, and a summary of feedback from the Steering Committee on S-TEK recommendations from May 8 meeting (Table 1).

Table 1. Status for FY12 S-TEK focus areas

FY12 focus	Summary of activities and recommendations	Status
Traditional Ecological Knowledge and Tribal/First Nations Priorities	Projects reviewed and recommendations to Steering Committee made 5/30. (see text below table)	Steering Committee accepted S-TEK recommendations. Seven projects funded. Obligated: \$261K
Priorities and Literature Synthesis for Terrestrial Habitats	May: Web-based expert panel discussions (completed) June 11: Expert Workshop in Arcata, CA (completed) Mid- July: Draft focus group report (all ecosystems) available for S-TEK consideration, final in mid-Aug May 2013: Literature synthesis and final report	Synthesis underway. Obligated: \$87K
GIS Data Layer Inventory / Mapping	<ul style="list-style-type: none"> ▪ S-TEK work group established ▪ Monthly coordination calls ▪ Identify foundational and secondary data sets ▪ Conducting data gap analysis and enhancing ability to access datasets in both B.C. and U.S. ▪ Expanding on cross-boundary data integration work on landcover to include the remainder of the Alaska/B.C. included in the NPLCC and the BC/WA border 	Monthly calls are ongoing. Obligated: \$55K

FY12 focus	Summary of activities and recommendations	Status
Data Management Platform	<ul style="list-style-type: none"> Data Management work group formed 14 Existing candidate platforms identified Critical attributes developed; platforms screened Recommended: <i>Landscape Conservation Management and Analysis Portal</i> (LC MAP) <ul style="list-style-type: none"> Mature, well-supported system Supports customization for NP LCC needs Used by the Great Northern, Southern Rockies, Great Plains LCCs Recommended forums to work with managers and database users 	Steering Committee accepted S-TEK recommendation. Obligated: \$56K
Science and Information Sharing Workshops / Symposia	<ul style="list-style-type: none"> Key future events and support levels identified at this point <ul style="list-style-type: none"> Cross-Boundary Data Integration Workshop, hosted by Simon Fraser University, Vancouver Cascadia Forum and Wildlinks hosted by Conservation NW PNW Climate Science Symposium Additional events may also be supported 	Steering Committee approved support for the identified events Obligated: total \$50K

RFP for work related to TEK. The RFP was published on www.grants.gov on April 24th. Twenty-one proposals were received, of which 18 met the eligibility requirements. The eligible proposals were a good mixture of work integrating TEK & Western Science and exploring integration of TEK into the NPLCC.

Ten reviewers from across the NPLCC evaluated each proposal on 7 evaluation criteria, and then reviewed and considered the resulting evaluations in several ways (overall scores and rankings, both average and by individual reviewers).

The reviewers recommended funding 5 projects as proposed, one with a reduced scope and budget, and a 7th to be supported if additional funds are available. The NW CSC is contributing \$40K to help fund two of the projects. Appendix B includes brief descriptions of the proposals supported.

Two day meeting overview

The agenda and several background documents were provided to the participants prior to the meeting, and the meeting discussions generally followed the planned order ("*S-TEK Agenda June 13-14.pdf*" and associated pre-reads will be available on the NPLCC website), although some topics (in particular the identification of potential information and support needs) took more time than planned. This summary focuses on the conclusions and remaining challenges identified during the meeting, with some of the detailed discussions included as an appendix.

Conclusions

Meeting participants reached several important conclusions, which helped identify the next steps and will be carried forward into the Strategy document. Some of the details within these major conclusions may be revised as the discussions continue.

Agreed on goals and objectives for the NPLCC Strategy for Science and Traditional Ecological Knowledge, 2013-2017 (S-TEK Strategy). Meeting participants discussed the goals of the S-TEK strategy that had been identified in previous discussions and summarized in a meeting pre-read ("*1: Objectives for the S-TEK strategy.pdf*"). The goals, as modified, are the following:

Primary goal of the S-TEK Strategy:

- A successful S-TEK strategy would maximize the ability of partners/constituents/stakeholders to make good conservation and sustainable resource management decisions under a changing climate (*NPLCC goal #1*). It would do so by providing "everything you need and nothing you don't, to better cope with climate change":
 - the right information (spatial or non-spatial data, TEK, case studies of adaptation action, etc.) at the right scale in the right way and at the right time, and
 - the tools, perspectives, and support needed to make appropriate use of the information.

Additional goals:

- *Identify* science and TEK information, tools, perspectives, and resources (and the integration of these resources) needed to support entities making conservation and sustainable resource management decisions throughout the NPLCC region (both on-the ground decision-makers and policy-level decision-makers), that are affected by climate change and related stressors (*related to NPLCC Goal #3*). This includes identifying all of the following:
 - What types of information and support are necessary? (i.e., information that provides decision-makers with improved understanding of how climate change and their management decisions may affect the outcomes of interest to them and an ability to use that information)
 - At what scale and scope is the information and support needed? (e.g., Many decisions are "local" and may require detailed local-level information, yet the scope of the LCC is landscape-level. It will be important to look at how local information can be scaled up or made relevant more broadly, and whether/how landscape-level information can be made relevant to decisions at a variety of scales)
 - When and in what form is the information and support needed? (explore how the various NPLCC partners make conservation and natural resource decisions, to better understand where in the decision process, and in what form(s), information and support is most useful)

- Determine what information gaps can be appropriately and adequately addressed by the NPLCC (related to NPLCC Goal #2), including both the type of information and the most useful ways in which it can be provided. This includes:
 - Recognizing and communicating that uncertainty exists and will remain: resource managers will continue to have to make decisions without full knowledge of everything they care about
 - Evaluating how effectively the information gap can be addressed
 - By the NPLCC, given realistic consideration of the budget, charter, and goals of the NPLCC
 - By other entities with interests in supporting landscape-level conservation and sustainable resource management
 - Identifying how information to support local decisions might be scaled to regional issues or needs.
- Recognize priorities and indicators that are important from a TEK perspective.
- Continue to build relationships and effective collaboration among NPLCC partner agencies through the development and implementation of the S-TEK Strategy
- Develop and provide the identified data, information, and knowledge to people making natural and sustainable resource management decisions in a way that they can make use of it effectively (*related to NPLCC goals #4 and #5*). Information and support development will occur through the annual implementation of the strategy.
- Include an engagement strategy to familiarize people with what the NPLCC is doing and how they can become involved).

Agreed on preliminary set of evaluation criteria for establishing priorities. The process for developing this S-TEK Strategy (See Figure 1 in the agenda) includes evaluating *potential* information and support needs using a consistent set of criteria. S-TEK members reviewed criteria proposed previously (see “2: *Criteria for info prioritization.pdf*” for additional discussion), and modified them in light of the meeting discussions.

Criteria for evaluating the importance of addressing an identified potential need, as modified:

- Value of information to decisions
 - Types of decisions the information could support (Critical / Useful / Not useful for each identified decision type)
 - Protection, mitigation, and restoration of habitats
 - Species management
 - Land use and management
 - Water use and management
 - Protection of cultural and historic resources

- Infrastructure placement, protection
 - Management / response to disturbances
- Importance or sensitivity of the decision (y/n for each type of sensitivity)
 - Biological sensitivity
 - Legal
 - Political sensitivity
- Partnerships
 - Number of partners or stakeholders with relevant information & tools or who have the need for that information and support (scale – below)
 - Information is relevant to the broad suite of LCC partners
 - Information is relevant to the decisions of some (3-5) partners
 - Information is relevant to the decisions of one partner
 - Information is not relevant to partner decisions
- Criticality of LCC-level participation (e.g., is not currently be addressed by anyone else)
 - What else is being done (by whom) related to this topic? (Basic data, collaboration, communication)
 - What type of information and support can the NPLCC provide, that isn't being done by others (y/n for each of the information types listed below)
 - Basic, fundamental, or “new” science, TEK, information, data or modeling (expanding or refining what's known about new or nascent areas of research; also information ‘nobody’ knows)
 - Analyses, integration, and coordination of existing data, datasets, models and information
 - Coordination and sharing of related databases and data collection activities, research results, tools, and management lessons among partners, made accessible in a useful and useable format
 - Understanding of and ability to use relevant information in decision-making (help in using information appropriately and effectively)
 - Communicating data/model results/information to various audiences (help with outreach to traditional and novel audiences)
- Timing of need / opportunity for information or support development
 - Urgency / timing of information needs relative to decision needs
 - Opportunity

Recognized the importance of including “portfolio-level” considerations when establishing priorities within the Strategy. It is useful to think of the S-TEK Strategy as defining a portfolio or collection of Science and TEK-related areas of focus. An effective and beneficial portfolio, like a portfolio of investments, often considers factors that relate to the collection of activities as a whole, which are not easily evaluated for an individual option (see “3: S-TEK Themes.pdf” for additional discussion). Although S-TEK members were not comfortable making a recommendation about what the appropriate mix of activities or priorities would look like at this point in the planning process, there was general agreement

that a Strategy that is too focused in one area, or on one type of information or support need would not be desirable. Several “diversity” considerations were identified and will be considered as part of the evaluation of potential information needs above:

- Geographic relevance of the needs (to States, Provinces, and Tribal/First Nations)
- Geographic scale of the issue (i.e., LCC-wide, cross-ecoregions, within a single ecoregion, smaller-than-ecoregion)
- Relevance to different ecosystems (Marine / coastal, Freshwater, Terrestrial) and across ecosystems
- Relevance to various outcomes of interest to management

Additional portfolio-level considerations were discussed and recognized as potentially important. It is not clear in what detail these considerations will be accommodated in the 2013-1017 S-TEK Strategy versus in the annual implementation plan (see further discussion in the “Challenges” section below):

- Consider a balance between Priorities or activities focused on understanding the extent of a problem and those focused on understanding the availability and effectiveness of management and adaptation solutions.
- Consider a balance across the various types of information and support that is developed, supported, and delivered (see further discussion immediately below).

Agreed on the critical importance of providing the “tools, perspectives, and support needed to make effective use of information” in addition to providing “information.” Throughout the meeting, participants reiterated that a lot of information relevant to NPLCC issues has been and is currently being developed, and that the NPLCC does not want to duplicate or re-invent such work. In many cases the main challenge may not be lack of information, but a lack of organization and integration of existing information, a lack of collaboration and coordination among various entities involved in developing related information, and/or a lack of tools and capacity to make effective use of information in decision-making (see “4: *Tools and support.pdf*” for some background on the various types of information that might be needed under different circumstances). The S-TEK agreed that one of the more useful functions of the NPLCC may turn out to be facilitating coordination, collaboration, and information use within the Partnership and that it is critical that the Strategy allow for the identification of these “support” needs as well as other information needs. This was also recognized as one the major challenges the S-TEK faces in developing the strategy, which is discussed below.

Challenges

A number of challenges in developing and implementing the S-TEK Strategy became clear during the two days of discussion, coming up as complications within several of the discussion topics. Each of these challenges remains to be worked through during the Strategy development, and the “working resolution” described below is likely to evolve.

Challenge: It is difficult for the S-TEK to separate the NPLCC goal of providing information and support from the fundamental conservation and sustainable resource management goals of the various partner agencies. As the S-TEK discussed identification of potential information needs, members often brought up the point that the task would be easier if we started with specific conservation goals that the NPLCC is trying to accomplish -- then they could identify what stressors and factors make it difficult to achieve those goals and what management actions could be taken. There are several reasons this is not a viable path at this time (1) the definition of the specific conservation goals needed for this approach are the exclusive province of the entities the NPLCC supports, and may legitimately differ between partners, and (2) the logic described is likely to lead to very narrowly defined information needs related to a specific decision by a single entity. The explicit goal of the NPLCC is to provide information and support to conservation and sustainable resource management decision makers that they can use to meet their own unique objectives, and to provide information that is useful to broad spectrum of the Partnership. Key to developing this partnership is to start by identifying and providing information and support that can be useful to multiple Partners even without those Partners having to agree to a single set of management goals.

Working resolution: Discussions will continue at future meetings.

Challenge: Defining the appropriate scope for the S-TEK and the S-TEK Strategy, relative to the scope(s) of the Steering Committee and other NPLCC subcommittees. It is not clear where the S-TEK “mission” ends and other NPLCC subcommittee responsibilities start. As the other subcommittees are just forming, it has been tempting to try to do “everything” within the S-TEK Strategy; for example, the statement of goals for the S-TEK Strategy (above) was expanded to include an “engagement” strategy to make people aware of what the NPLCC is doing. This goal might better fall within the purview of the Outreach and Communication Subcommittee, which is just being formed.

Working resolution: The relationship between the Subcommittees and their respective Strategies will evolve as the other subcommittees get up and running. In the interim, the S-TEK will focus most of their attention on developing a set of priorities for developing, supporting, and delivering information and support relevant to partner-decision making. The importance of communication and collaboration will be recognized in the implementation of the Strategy, and the S-TEK will work with other subcommittees as necessary to help ensure that the broader need for communication (including with the general public) and collaboration among NPLCC Partners is recognized.

Challenge: There is no single, clear organizing principle around which potential information and support needs can be organized at an appropriate level of aggregation for the Strategy. Prior to this meeting potential information and support needs that the NPLCC might address within the S-TEK Strategy had been identified from multiple perspectives:

- Two distinct efforts focused on identifying potential information needs from science and ecological processes perspectives
 - “Science synthesis” reports prepared by the National Wildlife Federation (NWF) summarizing the state of the science on climate impacts in Marine, Coastal, and

Freshwater ecosystems in the NPLCC region. These reports were summarized during the February 29th, 2012 meeting of the S-TEK (presentation and reports are available on the NPLCC website)

- Three S-TEK conference calls building on the NWF findings and identifying connections between resources of management interest, the ecological processes affecting those resources, the relevant decisions, and potential information needs. Summaries of these calls were provided to the participants prior to the meeting.
- Two efforts focused on identifying potential information and support needs from the perspective of the types of decisions the NPLCC intends to support
 - Steering Committee Framing Workshop discussions.
 - NWF-led focus groups. The focus groups followed the development of the science synthesis reports and were intended to identify information and support needs from the perspectives of resource managers. They were completed just 2 days prior to this meeting and Patricia Tillman (NWF) briefly summarized the preliminary results at the meeting.

A key task for this meeting was to take these various lists of potential information needs and (a) decide if they were sufficiently comprehensive, and (b) decide how to refine and narrow the laundry list of “everything anyone could think of” to a list of potential topics that can be evaluated in sufficient detail to set priorities for the S-TEK Strategy. The bulk of meeting discussions focused on this second question. Participants reviewed potential information needs identified to date through all of the mechanisms described above and reviewed influence diagrams illustrating a combination of those information needs. They then formed break-out groups to discuss how the topics identified within each ecosystem could be refined and re-framed to form potential topics or areas of focus for the 4-year strategy. (The results of these discussions are included in Appendix C). What emerged was not a consensus on how best to organize the potential topics, but a further expansion of the variety of ways topics could be grouped, summarized, or prioritized. The main organizational structures proposed were:

- By valued or vulnerable resource, which leads to several types of information and support needs: understanding the current stresses on that resource, what will happen to the resources under current projections, and what can be done to mitigate damage.
- By ecosystem process, which leads to a different description of types of information and support needs: understanding how each process is changing with climate change, what resources would be affected by those changes, and what can be done to mitigate or adapt to the process changes
- By decision type, which leads to a third description of types of information and support needs: understanding the outcomes of interest and the key uncertainties that make it challenging to predict the outcomes of potential management actions.

Each of these organizing principles has strengths and weaknesses, and the S-TEK decided to proceed with a combination of the first two elements, while including an emphasis on decision-relevance in the prioritization process.

Working resolution: See “Next Steps.”

Challenge: S-TEK members noted that it is easy and tempting to fall into a “science first” perspective in identifying and discussion potential information and support needs and to lose sight of the “support” aspect.

Working resolution: The Strategy document will include a discussion of the different types of information and support that the NPLCC can develop, support, and deliver, and will emphasize that the appropriate type of information and support is likely to vary by topic or focus area. The annual implementation planning process will include identification of the type of information and support (within each topic area) will be most useful to NPLCC partners and decision-makers. S-TEK members will exercise diligence in continuing to raise and consider the importance of different types of information and support. Either the S-TEK Strategy or the annual implementation plans (or both) may include a process or activities specifically aimed at evaluating the effectiveness of NPLCC-information delivery and use.

Next Steps, Action Items, and Future Meetings

Two key next steps were defined:

- Develop a short-list of potential information and support needs identified to-date that the S-TEK agrees should be evaluated in more detail as potential areas of focus for the S-TEK Strategy
- Develop / refine an outline for the S-TEK Strategy document.

Developing a short-list of possible information and support needs. The S-TEK agreed to organize the potential information needs around a combination of climate change-related “drivers” of change and valued natural and cultural resources. During and after the meeting, participants developed a list of about 20 climate-related drivers, and about 40 (later grouped into 25) categories of valued natural and cultural resources, most of which were relevant across the three ecosystems that had been used to organize the prior discussions. S-TEK members will individually review this matrix and identify driver-resource pairs (e.g., the impacts of changes in atmospheric composition on forest habitats; the impacts of changes in freshwater quality on anadromous fish, etc) and identify those pairs they believe are the most important areas for the NPLCC to focus on in the next four years. The matrix and instructions for this exercise were distributed to the S-TEK on June 22.

Outline for the S-TEK Strategy document. Frank Shipley (Chair) briefly reviewed a draft outline for the S-TEK Strategy at the end of the meeting. He will work with the NPLCC Staff and consultant to develop a revised version of the outline that includes an approach for addressing some of the challenges described above and to clarify the level of detail anticipated to be in the 2013-2017 Strategy and the level of detail anticipated for the annual implementation plan.

The action item table (Table 2) describes briefly some of the additional steps anticipated for after the July 10th Meeting.

Future meetings. The two-day meeting closed with a brief discussion of how to improve the effectiveness of the web-ex conference calls that are necessary due to travel restrictions. A decision was made to try to join together via webinar several “central” locations (rather than individual offices) if possible. The USFS will provide facilities in Juneau, Seattle, and Portland where S-TEK members in the area can meet together and then join other groups via web and phone. Space is also available in Corvallis and possibly in Arcata. Details on meeting locations are provided in the cover email transmitting these draft notes.

Upcoming meetings are currently scheduled for:

- July 10th, 1:30 – 4:30pm PDT. Video conference call/WebEx.
- Aug 10th, 9:00 am – noon PDT. Video conference call/ WebEx
- Sept 25th, 9:00 am – noon, PDT. Video conference call/ WebEx

Table 2. Action items from June 13-14 meeting and overall schedule

Action	Who	When
Finalizing the identification of topics to be considered as potential areas of focus within the S-TEK Strategy		
Review meeting results and consolidate the lists of resources of management interest and ecological processes to be considered	Andrea Woodward, Frank Shipley, Mary Mahaffy	By 6/22 (Done)
Develop instructions for how to use the table to identify topic areas; distribute to S-TEK members	Frank S., Mary M. and Karen Jenni	Distribute to S-TEK by 6/22 (Done)
Identify topics (combination of process and resource) to be considered as potential topics for prioritization, using the template provided.	All S-TEK subcommittee members	Responses to Mary Mahaffy and Karen Jenni by 7/3.
Refine outline of Strategy document, distribute to S-TEK for discussion during 7/10 call	Frank, Mary, Karen	Draft outline to the S-TEK by 7/9
Review the topics identified and select the set of potential topics to be evaluated	All S-TEK subcommittee members	7/10 S-TEK meeting/call
Evaluating topics to be considered as potential areas of focus within the S-TEK Strategy		
Review and test the evaluation criteria and portfolio considerations	All S-TEK subcommittee members	7/10 S-TEK meeting/call
Decide on process for conducting the evaluation between 7/10 and 8/3	All S-TEK subcommittee members	7/10 S-TEK meeting/call
Conduct evaluation	TBD	By 8/3
Decide on (Draft) Priorities to be included in the S-TEK Strategy		
Review evaluation results; apply portfolio considerations		8/10 S-TEK meeting / call
Develop draft priorities and questions for Steering Committee		8/10 S-TEK meeting / call

Appendix A. Meeting participants

Name	Agency	(I)n person or by (P)hone/web	
		June 13	June 14
Subcommittee members			
Frank Shipley (Chair)	USGS	I	I
Lyman Thorsteinson	USGS	I	I
Phil Van Mantgem	USGS	P	
Andrea Woodward	USGS	I	I
Keith Hatch	BIA	I	
Regina Rochefort (alt)	NPS	I	I
Kathryn Boyer	NRCS	I	I
Peter Kiffney	NOAA	P	P
John Laurence	USFS	P	
Frank Lake	USFS	P	P
Bill Hanson	USFWS	P	
Steve Morey	USFWS	P	
Charlie Chamberlain	USFWS	I	I
Tim Quinn	Washington DFW	I	I
Sue Rodman	Alaska DFG	I	I
Kathleen Sloan	Yurok Tribe	I	I
Mike Goldstein	USFS	I	I
Mark Petri	PCJV - U.S. / Ducks Unlimited	P	
Dan Siemann	National Wildlife Federation	I	I
Jennie Hoffman	EcoAdapt	P	P
Kathie Dello	CIRC (NOAA RISA)/OSU	I	I
Kathy Lynn	OSU / Tribal Network	I	
Additional participants			
Simone Ballard	BIA	I	I
Kelly Nesvacil	Alaska DFG	I	I
Patricia Tillmann	NWF - presenter	I	I
Stephen Zylstra	FWS	I	I
Mary Mahaffy	NPLCC Science coordinator	I	I
John Mankowski	NPLCC Coordinator	I	I
Karen Jenni	Insight Decisions, LLC	I	I

Appendix B. North Pacific Landscape Conservation Cooperative 2012 Funding Announcement

The North Pacific Landscape Conservation Cooperative (NPLCC) is pleased to announce the award of over \$300,000 to seven projects that address using Traditional Ecological Knowledge, where appropriate, to help inform natural and cultural resource management. The U.S. Fish and Wildlife Service provided funds to the NPLCC for these projects. Two of the projects are co-sponsored by the Northwest Climate Science Center (NW CSC).

All of the projects were submitted in response to a request for proposals in April, 2012. Proposals were evaluated by a review team from the NPLCC's Science-Traditional Ecological Knowledge Subcommittee and were approved for funding by the NPLCC Steering Committee.

The following is a summary of the seven 2012 funded projects.

Project Title: Determine if climate change can affect the gathering calendar and natural resources

Project Lead: Organized Village of Kasaan

Funding: \$49,974

Summary: Utilize traditional ecological knowledge to establish traditional gathering practices. Determine potential Climate Change Impacts to natural resources and ecosystems. Conduct interview with "traditional gatherers" (a.k.a. subsistence) over the last two generations to get baseline data.

Project Title: Implementing ecosystem-based management in the central coast of British Columbia: Support for Heiltsuk participation in strategic landscape reserve design process

Project Lead: Heiltsuk Integrated Resource Management Department

Funding: \$50,000

Summary: The project incorporates Heiltsuk Traditional Knowledge and Values into ecosystem-based management planning within Strategic Landscape Reserve Design (SLRD) Landscape Units. The SLRD process seeks to identify areas to set aside from logging (harvesting) over short and long term timeframes. Heiltsuk Traditional Use Studies (HTUS) identify harvesting and other types of cultural sites that are important to Heiltsuk well-being. HTUS data has been incorporated into GIS so that it can inform a wide range of spatial analyses. The base-line study, Map Biography, also identifies knowledge holders who will be engaged in identifying management principles.

Project Title: Correlation and climate sensitivity of human health and environmental indicators in the Salish Sea

Project Lead: Swinomish Tribe

Funding: \$49,832 (NW CSC and NPLCC are cost sharing this project)

Summary: The overarching goal of the project is to develop overlapping conceptual models of environmental and community health indicators in reference to climate forecasts. The sensitivity of species and habitats to climate will be cross-walked with recently developed Coast Salish community health indicators (e.g. ceremonial use, knowledge exchange, and physiological well-being) in order to demonstrate how Indigenous Knowledge can be used in conjunction with established landscape-level conservation indicators (e.g. shellfish and water-quality) and employed to identify resource management priorities. While results will be unique to study participants, no Indigenous community in the coastal Pacific Northwest is immune to the impending threats of climate change and land-use policies; the methods developed through this proposal will be applicable for other First Nations and Tribes across the region.

Project Title: Gathering Our Thoughts: Tribal recommendations on a traditional knowledge management framework for the NPLCC

Project Lead: Tulalip Tribe

Funding: \$43,410

Summary: Initiate the first large-scale Tribal government discussions on the relationship of scientific research and traditional knowledge (TK) in the activities of the NPLCC. The project will: 1. Review existing approaches and protocols related to scientific research and traditional knowledge in the Pacific Northwest, characterizing different types of traditional knowledge and the contexts in which these are encountered; 2. Initiate discussions among the 21 member Tribes of the Northwest Indian Fisheries Commission (all other Tribes are welcome to join); 3. Report on their views; 4. Propose a framework for the use of TK based on discussions and present it for a possible consensus by all participants; 5. Outreach with the products to other Tribes.

Project Title: Preserving Tribal Self-Determination and Knowledge Sovereignty While Expanding Use of Tribal Knowledge and Management in Off Reservation Lands in the Face of Climate Change

Project Lead: Karuk Tribe

Funding: \$34,386

Summary: For Tribes where significant knowledge of traditional management practices is intact, but where all or part of ancestral lands are managed by other agencies, it is important that the sharing of TEK and implementation of management take place in a manner that promotes rather than hinders Tribal sovereignty and self-determination. This project will identify existing institutional and cultural barriers to the sharing of Tribal TEK and expansion of Tribal management and provide recommendations for their resolution at local, regional and national levels.

Project Title: Utilizing Yurok traditional ecological knowledge to inform climate change priorities

Project Lead: Yurok Tribe

Funding: \$47,229 (NW CSC and NPLCC are cost sharing this project)

Summary: The Yurok Tribe will conduct a two phase study on Climate change impacts on Yurok Ancestral and Reservation Lands and resources, specific to impacts on wildlife and habitats that support culturally significant species. The first phase will be the collection and documentation of TEK through community scoping and structured interviews that will be recorded, transcribed, and entered into a GIS (mapped). The second phase will consist of analyzing the data collected in order to identify scientific information needs, data gaps and priority resources of concern specific to Climate change impacts that will be summarized in a final report to inform future funding, management and research efforts.

Project Title: Using TEK to model the effects of cc and SLR on coastal cultural resources at Tolowa Dunes State Park, CA

Project Lead: California Department of Parks and Recreation

Funding: \$25,994

Summary: The primary goals of this ongoing project are to obtain information regarding past catastrophic events such as tsunamis; TEK through oral history interviews with Tolowa elders regarding the effects of climate change and tsunamis on traditional smelt fishing camps; generate a Geographic Information Systems (GIS) model of coastal inundation due to sea level rise and overlay that with known archaeological and ethnographic resources; and generate a final report with detailed information of past tsunami events, and modeling the potential effects of climate change and sea level rise on archaeological and ethnographic Tolowa sites using TEK and GIS based upon the results of this study.

Appendix C. Summary of meeting discussions of potential information needs by ecosystem

As described above, meeting participants reviewed potential information needs identified to date (by ecosystem), and then formed break-out groups to discuss how the topics identified within each ecosystem could be refined and re-framed to form potential topics or areas of focus for the 4-year strategy. This Appendix summarizes the key elements of those discussions.

Marine and Coastal Ecosystems

This break-out group organized their topics around specific management-relevant questions, essentially conducting a preliminary prioritization of topics by considering three related questions: Where are there information gaps between what we know and what we need to know, what are areas where management actions can be taken, and then what should we (the NPLCC) do in the next 4 years to better inform those possible actions. They identified four main topic areas and also included some discussion of more specific areas within each topic. These more specific elements are examples of what might be expanded on in the annual implementation plan.

- How do we address changing shoreline habitat quality and locations and its impacts on species that depend on those habitats
 - Consider the effects of sea level rise, land elevation change, sedimentation, armoring
- How do we alter management of forage fish to insure population health and their critical role in the food web?
 - Consider the effects of harvest, predation, availability and quantity of spawning and rearing habitat
 - Consider the potential impacts of changes in forage fish populations given their role:
 - in the food web (effects on higher trophic levels)
 - as traditional foods
- How do we minimize or reduce the effects of ocean acidification on shellfish?
 - Consider the relationship between acidification and with land-based pollution/contaminants (also increased temperatures, increased runoff, nutrients, etc.)
 - Consider the availability and effectiveness of adaptation strategies
- Should harvest policies change based on shifts in fish populations (range shifts)?
 - Consider changes in the location and suitability of habitats, changes in invasive species and diseases, and the effects of both on populations of commercially and culturally important fish
 - Consider the effect of changes in harvest policy on those populations

Freshwater Ecosystems

Rather than trying to select a subset of topics from the longer lists like the group above did, the Freshwater Ecosystem break-out group attempted to consolidate the potential information needs into larger categories. Within each of these broad categories, they either identified some of the critical

changes and processes, or provided additional detail or sub-groups of resources/processes that could be considered. From a decision-support perspective, the subgroup focused on the “4H’s” of water management (habitat, hatcheries, harvest and hydropower) and cross-walked the list developed below to these four “H’s.” As almost everything in the list could be connected to at least one of these factors, and these are the four factors that are often considered in making water management decisions, it was determined that all the potential topics were decision-relevant.

- Environmental flows / water characteristics
 - Spring freshwater input timing, iceout / breakup, related physical and biological processes
 - Fall flows – effects on egg laying
 - Summer flows (low flows, high temperatures, effects on fishes)
 - Water temperature, water quality, water quantity
 - Extreme events
- Focal species
 - Tribal Trust / First Nations Trust species
 - Commercially important
 - Recreation/sportfish
 - Invertebrates
 - Vertebrates
 - T&E / species of special concern
 - Anadromous / resident
- Freshwater Habitat Types
 - Streams
 - Glacier-melt, snow melt, etc
 - Riverine
 - Lakes
 - Wetlands
 - Cold-water refugia
 - Watershed systems / integrity (noting there are different watershed types that will be affected differently by changes in climate)
- Human / Cultural Resources
 - Fish camp sites
 - Swimming / Boating
 - Fishing access
 - Economic relationships
 - Hydro / wind power
 - Commerce and travel
 - Urbanization

During discussion of these results, participants focused in on three questions that could be asked about each of the topics as a way to go from topic areas to potential information needs: What are current

trajectories/projections of climate impacts?, what is the vulnerability or resilience of valued resources in this ecosystem to those changes?, and what management tools are available and how well will they work? Each of these questions is relevant to the prioritization of information needs, and will be discussed during the prioritization steps.

Terrestrial Ecosystems

The Terrestrial Ecosystems break-out group took a third approach to this task, and offered three different ways that potential topics within the terrestrial ecosystem could be categorized:

- Resources of management interest (as previously identified, possibly grouped or organized differently)
- Ecological processes expected to change with climate (as listed previously, possibly grouped or organized differently)

The group also considered organizing around decisions, but felt that would not work as well as either a resource or process focus. They also discussed organizing around focal species, but felt that was too narrow of a focus for the Strategy.

Finally, this break-out group offered a third way of identifying/organizing information needs, attempting to identify processes or resources that are relevant in multiple ecosystem, not just within terrestrial ecosystems. For example: Disturbances, resilience of habitats and species to change, habitat connectivity, and foodwebs are relevant across the NPLCC. Focusing in on specifics within the Terrestrial ecosystem lead to the following four areas within which numerous potential information needs might be identified

- Changes in the distribution of major vegetative types (Forests, alpine, prairie/oak) and the connectivity within a type (especially due to changes in disturbance regimes, temperature, precipitation, etc)
- Forest productivity
- Island ecosystems
- Terrestrial food webs